

The Use Of Cryosurgery In The Management Of Oral Lesions



Management

KEYWORDS :

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ABSTRACT

Cryosurgery is the use of extreme cold produced by liquid nitrogen (or argon gas) to destroy abnormal tissue. Cryosurgery is used to treat external lesions where liquid nitrogen is applied directly to the cells with a cotton swab or spraying device. Cryosurgery is also used to treat lesions inside the body (internal). For internal lesions, liquid nitrogen or argon gas is circulated through a hollow instrument called a cryoprobe, which is placed in contact with the tumor. Its main advantage include absence of bleeding, incidence of secondary infection, minimal scarring and pain and low treatment cost. This review article underlines the uses of cryosurgery in the field of dentistry, especially for treatment of oral lesions.

INTRODUCTION

Cryosurgery is the local or general use of low temperature in medical therapy. It is a method of deliberate destruction of tissue by controlled cooling. James Arnot (1857) was first to report on therapeutic use of low temperature in malignant disease by means of salt /ice mixture applied to breast neoplasm¹. Its goal is to decrease cellular metabolism, increase cell survival, decrease inflammation, decrease pain and spasm, promote vasoconstriction and when use of extreme temperature, to destroy cells by crystallization. Its main advantage include absence of bleeding, low incidence of secondary infection, minimal scarring and pain and low treatment cost.²⁻⁹

Cryosurgery is now been used worldwide. In this review article, the uses of cryosurgery in the field of dentistry, especially in the treatment of oral lesion is highlighted. Cryosurgery is effective in the treatment of several oral lesions like leukoplakia, pyogenic granuloma, mucocele, vascular lesions and many others.

HISTORY OF CRYOSURGERY

Using cold as a treatment mode for trauma and inflammation was first accounted by the Egyptians. A sub zero temperature was used for the treatment of sprains, swelling, reduction of pain and many other medical disorder¹⁴. In the last century, Baron-Lorrey has used this method as an anaesthesia and sedation for amputation in soldier.^{15,16}

A senior English physician of Brighton Infirmary, James Arnott (1797-1883) used extreme cold locally for the destruction of tissue. He used a mixture of salt and crushed ice to relief pain and local haemorrhage. Because of his effort, he won a prize medal in The Great Exhibition of London in 1851. Initially he used this method for the treatment of breast cancer, uterine cancer and some skin cancer. He also advocated the use of this cold treatment for acne, neuralgia and headache.

PRINCIPLE OF CRYOSURGERY

Cryosurgery involves the repeated freezing and thawing of target tissue. Freezing should occur quickly because this forces the ice crystals to form intracellularly, where they are most lethal. The core temperature needed for a lesion to be destroyed is between -20°C and -40°C. Freezing to -40°C or below at a rapid rate (-100°C per minute) results in more than 90 percent cell death. In contrast, the tissue should be thawed slowly. This allows the intracellular ice crystals to increase in size before they melt (rapid thawing leads to immediate melting).

Intracellular ice crystals can cause cell death directly by damaging mitochondria or other micro-organelles. However, they may also lead to cellular dehydration and a toxic increase in the concentration of intracellular electrolytes, both of which promote the flow of extracellular fluid into the cell once the permeability increases due to freezing-induced denaturation of lipoproteins complexes in the membranes. The result is cell swelling and rupture.

Cryosurgery also induces microvascular changes. These include

initial vasoconstriction of arterioles and venules, modification of vascular endothelium, increased permeability of vascular walls, increased blood viscosity, lower intracapillary hydrostatic pressure, decreased blood flow, and formation of platelet plugs. Thrombosis of the feeding vessels causes the microcirculation of the target tissue to cease soon after thawing. This has a hemostatic effect that explains why bleeding is usually minimal as ischemic necrosis occurs. The end result is a clear line of demarcation between previously frozen tissue and unfrozen tissue.

Certain tissues are highly sensitive to freezing-induced destruction (ie, cryosensitive), while others are less sensitive (ie, cryoresistant). Examples of cryosensitive tissues include the skin, mucous membrane, and granulation tissue. Examples of cryoresistant tissues include fat, cartilage, fibrous, and connective tissue. Tumor cells are generally more cryosensitive than normal cells. Tissue sensitivity is probably related to the adequacy of the microcirculation, with more vascular tissues being more cryosensitive



Figure 1-Flow chart showing mechanism of cryoinjury

The possible mechanism of tissue injury is represented in the flow chart above. It is divided into 1) effect of cooling 2) effect of freezing 3) effect of warming and 4) effect of thermal history. All this eventually leads to controlled tissue destruction.

METHOD OF TREATMENT

The dose of liquid nitrogen and the choice of delivery method depend on the size, tissue type and depth of lesion. Other factors to be considered include the thickness of epidermis and underlying structure, the water content of the skin and local blood flow. The liquid nitrogen spray method for lesions of different size include the time spot freeze technique, the rotary or spiral pattern and the paintbrush method.

-Timed spot freeze technique¹⁸

This method of treatment offers a greater standardization of liquid nitrogen delivery and the most appropriate method for physicians who are new to this form of treatment. This method utilizes a small spray gun that holds around 300-500 ml of liquid nitrogen with a nozzle that range from A through F, with F being the smallest aperture.

The nozzle of the spray gun is positioned 1 to 1.5cm from the skin surface and aimed at the centre of target lesion. The spray gun trigger is depressed, and the liquid nitrogen is sprayed until an ice field encompasses the lesion and desired margins

Once the ice field has filled the specific margins, the spray needs to be maintained, with the spray canister trigger pressure and, thus, the liquid nitrogen spray flow adjusted to keep the target field frozen for an adequate time. This time may vary from five to 30 seconds beyond the initial time for formation of ice field. If more than one freeze-thaw cycle is required for lesion destruction, complete thawing should be allowed before next cycle (around 2-3 minutes)

This method of timed spot freeze technique are adequate for tissue destruction in an ice field up to 2cm in diameter. The best approach for lesion larger than 2cm is to use overlapping treatment field.

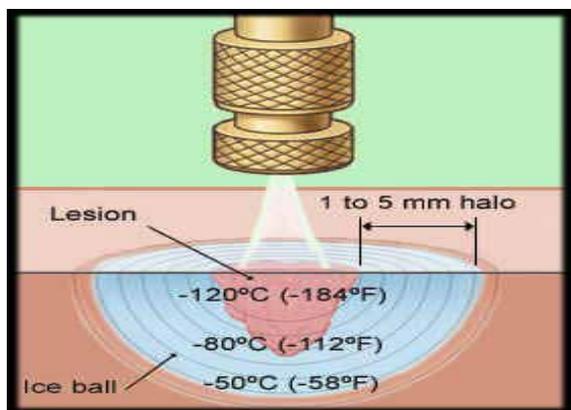


Figure 2-method of treatment of cryosurgery

CRYOSURGERY: A TREATMENT OPTION FOR ORAL LESION

Cryosurgery has been used in treatment of keratotic, hyperplastic, granulomatous, vascular and salivary gland lesions.¹² The uses of cryosurgery include :-

i) Hyperkeratosis and leukoplakia of oral mucosa.¹³

Some of the most recalcitrant lesion in oral cavity are chronic white patches. Chronic irritation, vit B12 deficiency, candidiasis is said to be the main cause of hyperkeratosis and leukoplakia. Topical application of cryoprobe on affected tissue had produced excellent results. Flattonsilar type probe is applied on the warm state of the mouth lesion and lifted up once freezing commences producing a saucer like ice ball in tissue thus leading to localized death of underlying tissue. Large lesion are treated by overlapping zones of freezing and a 2nd freeze exposure at same sitting reinforce degree of cold injury.

ii) Lymphangioma¹³

This tumor is presented from birth and it is most commonly found in the floor of the mouth. Due to its high fluid content and poor blood supply, cryosurgery is a suitable mode of treatment. Handerson (1971) has reported on the successful treatment of intraoral lymphangioma using cryosurgery as a treatment option.

iii) Hemangioma and other vascular naevi¹³

Cryosurgery treatment in hemangioma is been uneventful, rare bleeding and cosmetically favourable. Within hours of consecutive freeze-thaw particularly on the lips, it swells considerably. The oedema is unsightly the dangerous. Nevertheless, patient

should be warned of changes likely to take place. The post operative management of frozen hemangioma differs slightly from others.

IV) Ulceration of oral mucosa.¹³

Application of cryoprobe to an oral ulcer, eg. aphthous, lichen planoid or herpetic, converts it into a cold injury ulcer. The ulcer will instantly be rendered painless but temporal course of healing is not reduced. Thus, it is more palliative than curative

V) Hyperplastic conditions¹⁷

Denture hyperplasia is usually seen in the lower labial sulcus. Simple excision may lead to loss of sulcus depth which may require vestibuloplasty to treat the short sulcus depth. Instead of this, cryosurgery can be done especially in the elderly and debilitated. The sulcus depth will not be much altered if cryosurgery is done.

VI) Oral cancer

In the years 1964 through 1974, 60 selected patients were treated by freezing in situ with the intent to cure the disease. Early result demonstrates the suitability of this method for high surgical risk patients and showed that the technique permitted avoidance of bone-sacrificing operations. Five year survival statistics show that cryosurgery was most successfully used to moderate sized cancer without lymphadenopathy.

Vii) Cryosurgery for basal cell carcinoma¹⁷

Cryosurgery may be considered for patients with small, clinically well-defined primary tumors. It is used for the management of basal cell carcinoma for patients with medical conditions that preclude other types of surgery.

viii) Actinic cheilitis

Is a form of cheilitis which is the counterpart of actinic keratosis of the skin and can develop into squamous cell carcinoma. In actinic cheilitis, there is thickening whitish discoloration of the lip at the border of the lip and skin. Focal actinic cheilitis can be easily treated by cryosurgery.

Ix) Oral Lichen planus

Oral lichen planus (OLP) is a chronic inflammatory disease that causes bilateral white striations, papules, or plaques on the buccal mucosa, tongue, and gingivae. Erythema, erosions, and blisters may or may not be present. Lichen planus can be treated using cryosurgery. The patient requires hospitalization and general anaesthesia but complete resolution of symptoms was seen within 1 week of therapy and healing of the ulcer occurred by day 16.



Figure-shows oral lichen planus treatment using cryosurgery. A) pre operative picture C) view of healed lesion after 6 weeks

ADVANTAGES OF CRYOSURGERY

It allows for the complete destruction of the selected volume of biological tissue regardless of being on the skin surface or within the body's organs.

Access to unhealthy tissues, subject to cryodestruction, is realized with minimal trauma to healthy tissues.

Method is painlessness (neither local nor general anaesthesia is demanded) and provides absence of bleeding during operations as well as postoperative period.

Cryodestruction enables quick healing, practically without leaving scars, while providing excellent cosmetic effect.

Postoperative restorative period is shortened significantly, which allows for large increase in the number of patients.

Minimal traumatic consequences, short time of operation, and the absence for the need of anaesthesia, essentially broadens the circle of patients, for whom other surgical operations are contraindicated effectively makes Cryosurgery to be the most prudent choice for treatment. (For example, for the elderly or persons that is hypersensitive to medicaments, etc.)

A large number of cryosurgical operations can be performed in the outpatient setting or in the day inpatient department, this essentially allows for a noticeable work load reduction of the inpatient department.

DISADVANTAGE OF CRYOSURGERY

As with the advantages of cryosurgery, the disadvantages can also be categorized into those for the clinician and those for the patient.

Disadvantages for the clinician include the following:

.Liquid nitrogen needs to be delivered and stored. A liquid nitrogen generator may be purchased. If that is not done, nitrous oxide tanks or other supplies will need to be replenished as needed.
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.The clinician must be certain of the diagnosis because no tissue will be sent for pathology.

.Cryosurgery is not as accurate as a scalpel or laser in cosmetic work.

Disadvantages for the patient include:

- .Erythema and swelling are the norm. Blistering is common
- . Pain, especially throbbing pain.
- .May require multiple visits.
- .Hypopigmentation

COMPLICATIONS OF CRYOSURGERY

The complications of cryosurgery is divided into expected complications, immediate but less common complications, delayed but rare complications ,prolonged and rare complications.

Expected complications (more often with longer, deeper freeze)

- .pain during freezing, thawing and healing
- .blister formation –sometimes haemorrhagic
- .intra dermal haemorrhage
- .edema around treatment site
- .weeping of fluid

Immediate but less common complications

- .headache
- .syncope

Delayed but rare complications

- .infection at wound site
- .haemorrhage from wound site
- .pyogenic granuloma

Prolonged and rare complications

- .milia
- .Hypertrophic scars
- .Neuropathic pain at cryosurgery site

FUTURE OF CRYOSURGERY

Computer treatment planning for cryosurgery is an area of research and development that will greatly assist the practicing physician and will promote improved quality assurance for clinical procedures. This method provide a good planning and precision image-guided treatment to obtain an optimal image outcome. This form of cryosurgery treatment planning systems are still at an early stage of development

Additional studies are needed to determine the effectiveness of cryosurgery in controlling cancer and improving survival. Data from these studies will allow physicians to compare cryosurgery with standard treatment options such as surgery, chemotherapy, and radiation. Moreover, physicians continue to examine the possibility of using cryosurgery in combination with other treatments

CONCLUSION

In conclusion, cryosurgery is an effective treatment option for variety lesion of head and neck region. It is suitable for infants, anxious patients and patient whom other treatments are contraindicated. In conclusion ,its simplicity in application, absence of post-operative infection ,scarring and with little or no recurrence makes cryosurgery a highly useful method in treating of oral lesion.

However, more studies and research need to be conducted to enlarge the scope of cryosurgery.

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